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the seeds of diseases. By the prick of a needle an animal may be inoculated with the specific disease that is named on the label of the phial, as with hydrophobia, diphtheria, or scarlet fever. This can be done with as much certainty as the farmer would sow the seeds of corn, rye, or wheat, knowing that he would get crops according to the sowing.

The majority of diseases, it now appears, are thus explicable. All the fevers and the contagious diseases, and many of the constitutional infections, are probably to be traced to the parasitic development which I have described. These diseases are results of a struggle for existence between man and minute forms of life. If these foreign organisms, the so-called saprophytes, gain a foothold, and the conditions continue favorable to their development, the man suffers or dies.

We are not considering the ethics of the subject. We shall not discuss which has the better right to survive, the saprophyte or the man. It is possible that in the vast scheme of the Cosmos, such a small portion of which we comprehend, good and sufficient reason may exist for the victory of the saprophyte. But from our standpoint we must regard our own existence as the more important. Man must consider as inimical to himself every object and every influence that tend to shorten, endanger, or injure his life, or impair his happiness. We are at war with myriads of lower organisms which are trying to live on us, and which by so doing injure, cripple, or kill us. Wars are children's games compared to these silent, invisible, deadly enemies which are ever about us, waiting for an unprotected spot on which to attack us. They have neither conscience nor feeling. They are the seeds of death. They respect neither sex, station, nor age. Their existence means misery, agony, and death to the human race. The issue is fairly before us. Let no man slight it or undervalue its magnitude. These enemies cannot be laughed or reasoned away. We cannot escape them. The most important question to-day is, How can we protect ourselves against the saprophyte?

PETER T. AUSTEN.

II.

RAPID TRANSIT IN CITIES.

THE PROBLEM of the rapid transportation of travellers within its own limits has not yet been satisfactorily solved by any of the large cities of Europe or America. As for travel upon regular lines of railway from city to city, probably very nearly the ultimate possibility of human accomplishment has been reached in the "Flying Scotchman," the "Flying Irishman," and the "Chicago Limited." At all events, it is difficult to see how much greater speed can be attained on rails of steel or iron within the reasonable limits of safety, even if we admit that electricity or some other substitute for steam (Mr. Keely's "motor," for instance) may be made available in the future. In intra-urban transit, however, much less marked progress has been made. The horse- or tram-car slowly displaced the omnibus or stage; and up to the present time this has been our chief reliance. Elevated and underground railways are scarcely more than a dozen years old, and their use thus far has been extremely limited. Such means of travel as are afforded by the underground railways of London and the elevated railroads of New York are as great an improvement upon the lumbering horse-car as an ordinary "way" train on our railroads is an advance upon the stage-coach of the olden time; and no greater. For travel in cities there has not yet been provided the correspondent of the railway "express" train. Until that is furnished, the problem stated in my opening sentence will not approach solution.

Ten years' experience has shown conclusively that the elevated-railway system of New York cannot furnish *rapid* transit. It has also shown beyond dispute that this is but a single step in the unfolding of the rapid-transit question. Already the elevated cars are as distressingly overcrowded as the horse-cars were twelve or fifteen years ago. Competent observers affirm that the underground roads of London have done no more for that city than the elevated roads have done for New York, even if they have done as much. Doubtless nine out of ten unprejudiced men who have travelled on both systems would unhesitatingly say that the elevated is preferable to the underground on account of light and ventilation, and at least its

equal in speed. The London roads are dark, smoky, badly lighted, without any pretence of furnishing fresh air, and, on the whole, about as uncomfortable as they well could be. This is the common verdict; and it has recently been confirmed by the careful observations of a man who has spent no little time and money in the endeavor to give the American metropolis adequate means of rapid transit.

In several of the smaller of our cities surface cars propelled by cables or some form of electric traction are in use; but these are incapable of attaining more than very moderate rates of speed. Six miles an hour is, I believe, about the average. That is clearly out of the question in discussing *rapid* transit, although there is no doubt that the cable or the electric motor is vastly to be preferred to horses as a means of propulsion. On the score of cleanliness alone the use of either of the two is to be advocated, even at a slight advance in cost. Merely by reason of decreased expense in street-cleaning, any city could well afford to make it worth while for its street-car companies to make the substitution.

The subject in hand, as related to the chief American city, is both easier and more difficult to be disposed of than when applied to most other cities. Manhattan Island being long and narrow, the question there is to carry a great multitude of people in one direction in the morning hours, and just as many in the opposite direction in the evening. In towns where there are numerous lines of travel radiating from a common centre, the conditions are in one way simplified. More rapid-transit roads are needed in this case, to be sure, but smaller carrying capacity is required. In New York arrangements must be made for transporting an immense number of passengers over a limited number of lines running north and south. I propose to consider the problem in connection with New York: the modifications needed to make the conclusions applicable to other cities will readily suggest themselves.

It is indispensable to provide for "through" and "way" trains, or for express and local travel. Hence four tracks will be required—two to be used for each sort of business. The road or roads should be so constructed as to permit express trains to be run at high rates of speed—forty miles an hour, if necessary. Such trains ought not to stop at shorter intervals than a mile; they would be used by long-distance passengers, or by people going to regular railway stations on the upper part of the island for the purpose of leaving the city. For suburban residents special "through" trains, or at least "through" cars, should be provided. The stations for local or "way" trains should be placed not further than a quarter or a third of a mile apart, and passengers should be permitted to pass freely from one class of trains to the other. These are the principal conditions to be met in any system that is brought forward before favorable consideration can be granted to it. The various methods proposed from time to time may be classified, in a general way, as falling under one or another of five groups. These I shall take up consecutively. It will be seen that three of them (perhaps four) are modifications of one cardinal idea.

First in order comes the "Arcade" system. The promoters of this propose to make an open cut along Broadway, which shall afterward be bridged over, and the present surface of the street practically restored. Within this cut, and just underneath the surface, the railway tracks are to be placed. The objections to this scheme are numerous. During the process of construction the city's principal street would be virtually closed against business. Sewers, gas-pipes and water-pipes would be seriously disturbed, and a rearrangement of them would be rendered necessary. Then there is grave doubt as to the effect of the excavation on the foundations of buildings in Broadway, and their owners would not consent to the work unless an adequate guarantee against damage were given. The damages might run up to untold millions, and capitalists would hesitate to assume such a risk. The plan is a practicable one, but there is extreme doubt whether it will ever be carried into execution.

A tunnel beneath a street, excavated at a sufficient depth not to interfere with traffic on the surface, is open to many of the same objections. The network of subterranean pipes would be an obstacle of no small dimensions, and, as with the "Arcade" plan, vaults would be invaded and foundations might be undermined. Of course, if the city itself should go into the business of constructing a rapid-transit system, as was proposed not long ago by a high authority, these obstacles would not be

found insuperable. On the general subject of tunnels it is well to say that the features of those in London which render them so objectionable may be obviated without great trouble. Especially will this be the case when the electric motor is brought into successful use. A limitless supply of pure air can readily be made certain, and even with steam locomotives there can be freedom from smoke. Now that cars can be supplied with electric lights, there is no reason why travel on underground roads may not be made comfortable.

A tunnel scheme that has met with considerable favor is one that proposes to run through the blocks, the company buying the right of way outright, and, after its work is completed, constructing such buildings on its property as it may deem best. The tunnel would comprise the cellars or basements of these buildings, and there could be no charge that private rights had been invaded. The privilege of crossing streets would have to be obtained from the authorities, and only at crossings would the tangle of "all sorts and conditions" of pipes cause annoyance. While the work of construction was in progress there need be little interference with public travel, as one crossing could be completed before permission was given to open another.

Perhaps the most attractive tunnel project is that which gets rid of all difficulties and obstacles growing out of work near the surface by the heroic remedy of making the excavation at a depth of 100 or 150 feet. A tunnel there would be blasted through solid rock—the "bed-rock" of the island—and the depth would be sufficient to prevent any disturbance at the surface during the progress of the work. Such an undertaking would be enormous in magnitude, but it presents no engineering difficulties that could not readily be overcome. Naturally, a matter of much interest would be the raising and lowering of passengers. With an abundant supply of huge elevators this could easily be accomplished, however; and it has even been suggested that the cars themselves might be placed on "lifts," and, when the passengers had taken their seats, quickly lowered to the tunnel and started on their way. One peculiar advantage of this plan for Manhattan Island is that subsidiary tunnels could be excavated from the southern end of New York to both the New Jersey and Long Island shores, thus bringing the city into immediate connection with the great railroad systems around it. On such a road-bed as would be provided, should this scheme be carried out, the highest speed would be practicable for express trains.

One other plan remains to be mentioned—a plan in many respects superior to any of those already passed in review. This is an elevated road built through the middle of blocks on ground purchased and owned by the company. But not an elevated road supported on stilts, like those that disfigure so many of New York's streets. Such structures can hardly be considered as more than temporary makeshifts. No serious accident has yet occurred on these roads, but there have been several "hairbreadth 'scapes," and many people have a firm belief that a horrible disaster is bound to happen sooner or later. Be that as it may, these elongated bridges must be renewed throughout from time to time, and I have little doubt that in a not very remote future they will be condemned and cast aside. The elevated structure through the middle of blocks will be a far different affair. It will be either a solid viaduct of masonry from end to end, or else a substantial earthwork with bridges at the street crossings. On this there could be reasonably rapid travel. Passengers would have the privilege of moving in the upper light and air, and the marring of the streets by unsightly structures would be reduced to a minimum. The railways that enter London on viaducts furnish a good model of what such a road would be.

In connection with each of these plans the element of cost is a consideration of the first magnitude. To estimate the expense in advance is not easy. But I think experience justifies the assertion that either of these projects, carried out on a handsome scale, would be a paying investment. It is a fairly well-established law that the greater the facilities for carrying people the greater will be the number of people to be carried. Take a single illustration. The horse-cars of New York have as many passengers now as they had a dozen years ago, in spite of the enormous crowds transported by the elevated roads. So it is within bounds to affirm that the capitalists who are far-seeing enough to put their money into a properly-constructed tunnel,

or a substantial elevated railroad through the middle of blocks, will be sure of an ample return in a few years at the furthest. Their advent is impatiently awaited.

ARCHIE EMERSON PALMER.

III.

CONSTITUTIONAL PATCHWORK.

RECENT attempts in several States so to amend the constitution as to incorporate a provision prohibiting the manufacture and sale of spirituous or intoxicating beverages render it a timely subject of inquiry whether such provisions are germane to the true purpose, object, and meaning of a fundamental framework of government.

They ought not to be so regarded. The sole and legitimate aim of a constitution is to declare those universal and well-recognized fundamental principles of equality, justice, freedom, and right which have been demonstrated in the experience of mankind and received the common consent. Any asserted rule or principle which has not obtained such support is of too doubtful a character to be classed among fundamental doctrines, and ought not to have the advantage of constitutional sanction. Once lowered to admit principles which belong to statutory provisions, and which are the outgrowth of temporary excitement or passing whim in the changeful popular opinion, government would soon lose all its permanency of character and efficiency in administration. Besides, until any avowed doctrine of government has so commended itself to the conservative reflection of a community as to achieve practical support and lodgment, it has little hope of accomplishing the result desired. As long as any statutory treatment of an offence has a public sentiment to sustain it, it will not need the strength of constitutional provision; when it ceases to possess the public support, it will not help its enforcement to have it embodied in the constitution. Nothing is gained by a constitutional declaration in behalf of a doubtful proposition: it neither convinces the popular mind nor strengthens the popular conscience. If it has to be put in the organic law to save it from fluctuations in the drift of popular opinion, it is hardly worth salvation; if it is in no danger therefrom, to embody it in the statute enactment is sufficient for its entire purpose, and gives it all the dignity and sanctity it requires.

The truth of the matter is that the same opinion which is needed to create a legislative machinery for the enforcement of a constitutional provision is all that is demanded to enact and enforce such a legal principle without marring the organic law. In other words, a legislature fresh from the people, and subject to the popular sentiment, which would provide means to enforce a constitutional amendment prohibiting any offence, would enact as strong statutory provisions to accomplish the same purpose; and a legislature which, reflecting a reverse popular sentiment, would decline or refuse to pass restrictive laws in relation to any subject, would be quite as indifferent to constitutional provisions looking in that direction. You may say that with a constitutional prohibition they are rendered powerless to sanction it by any permissive legislation. True; but the only result would be an illegal occupation permitted to continue by tacit consent. You may urge, further, that such a prohibition would place the legislature under constitutional obligation to enact the "proper restrictive legislation." True; but very little is accomplished in attempting to legislate against a recognized public opinion, at least in relation to social customs and habits.

But the gravest objection to such constitutional patchwork is its tendency to lower and belittle the dignity and character of our organic law. The repose of society is of no small value, and permanence in fundamental principles is essential to the stability of our institutions and the peace and good order of society.

The more the individual can be left to govern himself, the safer and better for the community. Educate the public mind, instruct the public conscience, direct the public thought and moral sense aright, and little law is needed to preserve the public welfare. Enact what statutes you please, make them rigid as you please, annex what penalties you please in advance of the popular sentiment, and it will only eventuate in reducing the respect for all law, in lax execution or non-enforcement, and finally